

What is claimed is:

1. A circuit protection device, comprising:
an overcurrent protection portion having a current limiting element and a
5 surface;
an overvoltage protection portion disposed on the surface with an attachment
structure and thermally coupled to the overcurrent protection portion; and
a plurality of terminations configured to connect the overcurrent protection
portion and the overvoltage protection portion to an electrical circuit.

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2. The device as defined in claim 1 wherein the current limiting element
includes a PTC element.

3. The device as defined in claim 1, wherein the overcurrent protection
15 portion includes a first substrate and a second substrate, each substrate having an
electrode disposed thereon, and the current limiting element positioned between the
first and second substrates and electrically connected to the electrodes.

4. The device as defined in claim 1, wherein the overcurrent protection
20 portion includes a first substrate and a second substrate, each substrate having an
electrode disposed thereon, and the current limiting element positioned between the
first and second substrates and electrically connected to the electrodes, the second
substrate further including at least one via that extends from the surface of the
overcurrent protection portion to the current limiting element, the at least one heat
25 conducting structure configured to thermally couple the overvoltage protection portion
to the overcurrent protection portion.

5. The device as defined in claim 4, wherein the at least one heat
conducting structure is metallized.

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6. The device as defined in claim 4, wherein the overvoltage protection portion is bonded to the overcurrent protection portion through the at least one heat conducting structure.

5 7. The device as defined in claim 1, wherein the overvoltage protection portion includes a voltage suppressor.

8. The device as defined in claim 1, wherein the overvoltage protection portion includes a voltage suppressor having zener diode-like characteristics.
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9. The device as defined in claim 1, wherein the overvoltage protection portion includes a bi-directional thyristor.

10. The device as defined in claim 1, wherein the overvoltage protection
15 portion includes a varistor.

11. The device as defined in claim 1, wherein the overvoltage protection portion includes a voltage suppressor and a voltage variable material.

12. The device as defined in claim 1, wherein the overcurrent protection portion includes a via that extends from the surface to the current limiting element to the overvoltage protection portion to thermally couple the current limiting element through the via.
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13. The device as defined in claim 1, wherein the overvoltage protection portion comprises a die having first and second sides each having an electrical contact.
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14. The device as defined in claim 13, wherein one of the first and second sides is electrically connected to the overcurrent protection via a metallized trace disposed on the surface of the overcurrent protection portion, wherein the metallized trace is electrically insulated from the current limiting element along the surface.
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15. The device as defined in claim 13, wherein one of the first and second sides is electrically connected to a contact via a bond wire.

16. The device as defined in claim 1, further comprising:

the overcurrent protection portion including a first substrate and a second
5 substrate;

the current limiting element positioned between the first and second substrates;

first and second electrodes respectively disposed on surfaces of the first and second substrates such that the current limiting element is positioned between the first and second electrodes;

10 at least one terminal electrically connecting a portion of the at least one terminal disposed on the surface to at least one of the first and second electrodes.

17. The device as defined in claim 16, wherein the at least one terminal further includes another portion comprising a via extending through at least the first
15 substrate.

18. The device as defined in claim 16, wherein the at least one terminal further includes another portion comprising a via extending through at least the first substrate, first electrode and the current limiting element.

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19. The device as defined in claim 18, wherein the via is electrically insulated from the first electrode.

20. An overcurrent and overvoltage protection device, comprising:

25 a first substrate having a surface and an electrode disposed on the first surface;

a second substrate having a top surface and a bottom surface and an electrode disposed on the bottom surface;

a PTC element positioned between the first and second substrates and electrically connected to the electrodes;

30 a voltage suppressor disposed on the top surface of the second substrate and thermally coupled to the PTC element; and

a plurality of terminations electrically connected to the PTC element and the voltage suppressor.

21. The device of claim 20, wherein the second substrate includes a heat sink configured within a footprint of the voltage suppressor, the heat sink extending from the top surface of the second substrate to the PTC element.

22. The device of claim 21, wherein the heat sink includes at least one via, the at least one via being coated with a conductive material.

23. The device of claim 21, wherein the heat sink includes a via, and the voltage suppressor is conductively bonded to the heat sink and via.

24. The device of claim 20, wherein the voltage suppressor has zener diode like characteristics.

25. The device of claim 20, wherein the voltage suppressor includes a bi-directional thyristor.

26. The device of claim 20, wherein the voltage suppressor includes a varistor.

27. The device of claim 20, further comprising:
a voltage variable material disposed on the top surface of the second substrate.

28. The device of claim 20, further comprising:
a voltage variable material disposed on the top surface between an input/output pad and ground.

29. A circuit protection device, comprising:
an overcurrent protection portion interposed between one or more substrate layers of a circuit board;

an overvoltage protection portion attached to the circuit board and thermally coupled to the overcurrent protection portion via a heat transferring structure within a least one of the substrate layers; and

at least one terminal configured to connect the circuit protection device to an
5 electrical circuit.

30. The device as defined in claim 29 wherein the overcurrent protection portion includes a current limiting element.

10 31. The device as defined in claim 30, wherein the overcurrent protection portion includes a first electrode and a second electrode with the current limiting element positioned between first and second substrates of the one or more substrate layers and electrically connected to the electrodes.

15 32. The device as defined in claim 30, wherein the heat transferring structure includes at least one via that extends from a surface of the circuit to the current limiting element, the at least one via configured to thermally couple the overvoltage protection portion to the current limiting element.

20 33. The device as defined in claim 32, wherein the at least one via is metallized.

34. The device as defined in claim 32, wherein the at least one via is filled with a heat conducting material.

25 35. The device as defined in claim 32, wherein the overvoltage protection portion is bonded to the circuit board through the at least one via.

30 36. The device as defined in claim 29, wherein the overvoltage protection portion includes a voltage suppressor.

37. The device as defined in claim 29, wherein the overvoltage protection portion includes a voltage suppressor having zener diode-like characteristics.

38. The device as defined in claim 29, wherein the overvoltage protection portion includes a bi-directional thyristor.

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39. The device as defined in claim 29, wherein the overvoltage protection portion includes a varistor.

40. The device as defined in claim 29, wherein the overvoltage protection portion includes a voltage suppressor and a voltage variable material.

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41. The device as defined in claim 30, wherein the device includes a via that extends through from the current limiting element and the overvoltage protection portion to thermally couple the current limiting element through the via.

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42. The device as defined in claim 29, wherein the overvoltage protection portion comprises a die having first and second sides each having an electrical contact.

43. The device as defined in claim 42, wherein one of the first and second sides is electrically connected to the overcurrent protection via a metallized trace disposed on the surface of the circuit board, wherein the metallized trace is electrically insulated from the current limiting element along the surface.

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44. The device as defined in claim 42, wherein one of the first and second sides is electrically connected to a contact via a bond wire.

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45. The device as defined in claim 30, further comprising:
the one or more substrate layers including a first substrate and a second substrate;
the current limiting element positioned between the first and second substrates;

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first and second electrodes respectively disposed on surfaces of the first and second substrates such that the current limiting element is positioned between the first and second electrodes;

5 at least one terminal electrically connecting a portion of the at least one terminal disposed on the surface to at least one of the first and second electrodes.

10 46. The device as defined in claim 45, wherein the at least one terminal further includes another portion comprising a via extending through at least the first substrate.

 47. The device as defined in claim 45, wherein the at least one terminal further includes another portion comprising a via extending through at least the first substrate, first electrode and the current limiting element.

15 48. The device as defined in claim 47, wherein the via is electrically insulated from the first electrode.